Claims

1. A method of processing a metal casting, comprising:

pouring a metal in molten form into a mold;

retaining the metal within the mold for a time and to a temperature sufficient to at least partially solidify the metal so as to form the casting:

placing the die in a heat treatment station for heat treating the casting within the mold with the casting aligned in a defined, indexed position; and

applying energy to the mold to increase the temperature of the casting within the mold and at least partially heat treat the casting while the casting is within the mold.

2. The method of claim 1 and wherein placing the mold in a heat treatment station further comprises placing the casting in an indexed position with a plurality of core openings of the casting aligned in a known, predefined alignment, and further heat treating the casting.

3. The method of claim 2 and further comprising the steps of:

aligning the core openings of the casting with a plurality of nozzles; and

directing a heated media from the plurality of nozzles at and into the core openings.

4. The method of claim 2 and wherein placing the casting in an indexed position comprises positioning the casting at a first position with x, y and z axes of the casting oriented in a known first orientation, and wherein the core openings are in alignment with the plurality of nozzles.

5. The method of claim 2 and further comprising:

placing the casting at a second position with x, y, and z axes of the casting oriented in a known, second orientation, different from the first orientation so that at least a portion of the core openings are in alignment with a second plurality of nozzles; and

directing a fluid flow from the second plurality of nozzles at the core openings.

6. The method of claim 1 and further comprising:

placing the casting in a first casting position with x, y, and z axes of the casting oriented in a known orientation;

moving a plurality of nozzles to a first nozzle position in alignment with at least a plurality of core access openings formed in the casting; and

moving at least a portion of the plurality of nozzles to a second nozzle position, wherein the portion of the plurality of

nozzles is in alignment with at least a second plurality of core openings formed in the casting.

7. The method of claim 1 and wherein applying energy to the mold comprises directing radiant energy against the mold which absorbs the radiant energy, and heating the mold and casting from outside the mold inwardly.

8. The method of claim 1 and wherein applying energy to the mold comprises directing inductive energy from an induction energy source against the mold to heat the mold and casting from inside the mold outwardly.

9. The method of claim 1 and wherein applying energy to mold comprises moving the mold through a pressurized chamber, drawing a flow of oxygen gas through the mold to promote combustion of a combustible binder material of the mold, and heating the casting with the combustion of the binder and oxygen gas.

10. A method of processing a metal casting, comprising:

providing a mold with a casting core;

pre-heating the die to a temperature sufficient to at least partially heat treat the metal of the casting;

pouring the metal into the mold to form the casting having a core and a series of core openings defined therein;

at least partially heat treating the metal of the castings in the mold; and

removing the core from the casting.

11. The method of claim 10 and wherein at least partially heat treating the metal in the mold comprises introducing a heated fluid media into the mold.

12. The method of claim 11 and further comprising cooling the mold and casting after pouring the metal in the mold to solidify the casting in the mold prior to heat treating.

13. The method of claim 10 and further comprising:

removing the casting from the mold;

positioning the casting at a first position so that x, y and z axes of the casting oriented in a known first orientation with a series of the core openings in alignment with a first plurality of nozzles; and

applying heat to the casting with the first plurality of nozzles to at least partially dislodge the core from the casting.

14. The method of claim 13 and further comprising:

positioning the casting at a second position with x, y and z axes of the casting oriented in a known second orientation, different from said first orientation and with at least a series of core openings in alignment with a second plurality of nozzles; and

applying heat to the casting with the second plurality of nozzles.

15. The method of claim 10, and wherein at least partially heat treating the casting comprises:

maintaining the mold and casting at a known position;

moving a plurality of nozzles to a first nozzle position about the mold;

applying heat to the mold with the nozzles to at least partially heat treat and dislodge the core from the casting;

moving at least a portion of the plurality of nozzles to a second nozzle position; and

further applying heat to the mold with the nozzles in their second nozzle position to further heat treat the casting within the mold.

16. The method of claim 10 and wherein the metal of the casting includes aluminum and the pre-heating step comprises pre-heating the mold to a temperature in the range of 400 - 600°.

17. The method of claim 10 and wherein applying energy to the mold comprises directing radiant energy against the mold which absorbs the radiant energy, and heating the mold and casting from outside the mold, inwardly.

18. The method of claim 10 and wherein applying energy to the mold comprises directing inductive energy from an induction energy source against the mold to heat the molds and casting from inside out.

19. The method of claim 10 and wherein applying energy to mold comprises moving the mold through a pressurized chamber, drawing a flow of oxygen gas through the mold to promote combustion of a combustible binder material of the mold, and heating the casting with the combustion of the binder and oxygen gas.

20. The method of claim 15 and wherein the casting core is formed from sand, and further comprising reclaiming the sand of the core with the removal of the core from the casting.

21. The method of claim 10 and further comprising quenching the casting.

22. The method of claim 11 and further comprising transferring the mold to a heat treatment line, arresting cooling of the metal within the mold, maintaining the metal with in the mold at a above a process control temperature, and thereafter moving the mold into the heat treatment station.

23. A system for manufacturing castings comprising:

a series of molds in which a molten metal and a core are received to define and form the castings;

a series of saddles adapted to receive the castings in a desired orientation having known, indexed position coordinates; and

a heat treatment station in which the saddles, with the castings located in their known, indexed position therein, are received for heat treatment of the castings and core removal, wherein said heat treatment station including:

at least one heating zone through which the castings are moved with the castings oriented in predefined, known positions, for applying heat to the castings to heat treat the castings

and cause the cores within the castings to be substantially dislodged from the castings.

24. The system of claim 23 and wherein said heat treatment station includes a plurality of nozzle stations each comprising a series of robotically operated nozzles adapted to move about the castings between at least first and second nozzle positions in alignment with a series of core openings formed in the castings for directing heat toward the castings from different directions to substantially break down and dislodge the cores from the castings.

25. The system of claim 23 and wherein said saddles each include a series of walls defining a casting receptacle and a plurality of locating devices positioned within said casting receptacle, so as to engage and guide the castings into their known, indexed positions having known position coordinates within said saddles.

26. The system of claim 25 and wherein said locating devices comprise guide pins and wherein the castings are formed in said molds with corresponding locating openings in which said guide pins are received for locating the castings in their known, indexed positions within said saddles.

27. The system of claim 23 and wherein said molds include an internal heating source for preheating said molds and at least partially heat treating the castings.

28. The system of claim 27 wherein said internal heating source comprises a heated fluid media received and/or circulated through said molds for heating said molds internally to a soak temperature for at least partially heat treating the castings therewithin.

29. The system of claim 23 and further comprising a radiant chamber positioned upstream from said heat treatment station and having at least one heat source, wherein heat is applied to the castings as they are received and move through said radiant chamber sufficient to arrest cooling of the castings to at least a process control temperature prior to the castings being moved into said heat treatment station.

30. A system for manufacturing of metal castings, comprising:

a mold in which a metal material is received for forming the casting therewithin;

a heat treatment station including at least one heat treatment chamber in which said mold is subjected to application of energy for at least partially heat treating the casting within the mold; and

wherein said at least one heat treatment chamber includes a heat source for heating said mold to a temperature sufficient to at least partially heat treat the casting therewithin.

31. The system of claim 30 wherein said heat source comprises at least one nozzle station positioned along said heat treatment chamber and having at least one nozzle station positioned along said heat treatment chamber and having at least one nozzle initially mounted in alignment with a series of openings formed in said mold for applying a fluid media to said mold for heating said mold and dislodging core material of a core within the casting.

32. The system of claim 30 and wherein said heat source comprises a radiant energy source mounted in said heating chamber so as to direct radiant energy toward said mold, which radiant energy is absorbed by said mold, for heating said mold and the casting therewithin.

33. The system of claim 30 and wherein said heat source comprises an induction energy source mounted within said heating chamber for transmitting inductive energy toward said mold, which inductive energy is absorbed by said mold for heating the casting within said mold.

34. The system of claim 30 and wherein said at least one heat treatment chamber comprises a pressurized chamber positioned along said heat treatment station for drawing a flow of oxygen gas through said molds for reacting and combusting with a binder material, in order to at least partially heat treat the castings within said mold as the binder material and oxygen gas are combusted.

35. The system of claim 30 and further comprising a quenching station for quenching the heat treated castings.

36. The system of claim 23 and further comprising a radiant chamber positioned upstream from said heat treatment station and having at least one heat source, wherein heat is applied to the castings in said radiant chamber to arrest cooling of the castings to at least a process control temperature prior to the castings being moved into said heat treatment station.

37. The system of claim 23 and wherein said heat treatment station includes a fluid bed within which the molds are received and for purposes of temperature control, heat-up and removal and reclamation of sand from the core and mold.